Astrometric and Space-Geodetic Observations of Polar Wander

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By definition, the Earth's changing mass distribution causes the Earth's inertia tensor to change which, by conservation of angular momentum, causes the Earth's rotation to change. The terrestrial location of the Earth's rotation pole has been under continuous observation since 1899 when the International Latitude Service (ILS) began conducting astrometric measurements of star positions to determine variations in station latitude and hence variations in the location of the rotation pole. lLS observations of polar motion continued to be made until 1979 when they were supplanted by observations taken by more accurate space-geodetic techniques. During the 1899.9–1979.0 span of the ILS measurements, the Earth's rotation pole is observed to drift at a mean rate of 3.9 milliarcseconds/year (mas/yr) towards −70°E longitude.

With the advent of space geodesy—with the placement of laser retro-reflectors on the Moon by Apollo astronauts and Soviet landers, the launch of the LAser GEOdynamics Satellite (LAGEOS), and the development of Very Long Baseline Interferometry and the Global Positioning System—a quantum leap has been taken in our ability to measure polar motion. By combining individual polar motion series determined by the various space-geodetic techniques, a combined polar motion series can be obtained that is based upon independent measurements and that spans the greatest possible time interval. SPACE96 is such a combined polar motion series that has been generated recently at the Jet Propulsion Laboratory. During the 1976.7–1997. 1 span of the SPACE96 polar motion series, the Earth's rotation pole is observed to drift at a mean rate of 4.2 mas/yr towards −88°E longitude, a drift that is in remarkable agreement with that evident in the less accurate, but longer, ILS polar motion series.